Vol. 112 No. 3 February 4, 1950

The American FERTILIZER

Published every other Saturday. Annual subscription: in the United States, 3.00; Canada and Mexico, 4.00; other countries, 5.00. Entered as second-class matter, January 15, 1910, at the Post Office at Philadelphia, Pa., under Act of March 3, 1879. Registered in United States Patent Office. Publication office, 317 N. Broad Sts., Phila. 3, Pa

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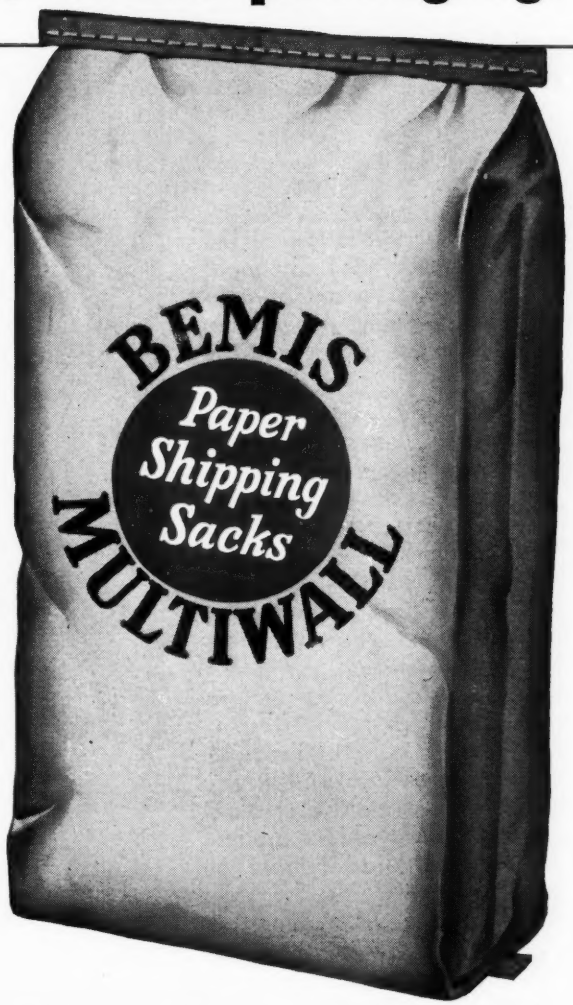

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The American FERTILIZER

Vol. 112 FEBRUARY 4, 1950 No. 3

Fertilizer Experiments and Crop Yields in Japan and Some Comparisons With those in the United States

By C. L. W. SWANSON[1]

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DURING the past 30 or more years, the Japanese have conducted many fertilizer experiments. Some of these were of short duration, lasting only one to three years, but others are still in operation after 15 or more years. The greater percentage are not experiments analogous to those conducted in the United States and Europe.

Many of the reports on field experiments contain meager information about the kind of soil on which the experiments were conducted. General information on the soils of Japan is now being obtained (*1, 12*).[2] Information on climate, physiography, land use and soils are given elsewhere (*12, 13*).

Because of increased demands on the relatively infertile soils of Japan for maximum production of food for an increasing population,[3] efficient use of all available fertilizers is vital. Because of Japan's hilly and mountainous terrain, the climate varies considerably from locality to locality. This microclimatic feature requires that experiments on fertilizers be carried on in these various regions. The importance of both commercial fertilizers and farm manures in the soil fertility program of Japan is discussed elsewhere (*14, 16*).

Field experiments in Japan are generally carried out on plots of two sizes. Those using very small plots, usually less than one square meter in area, are known as "frame" experiments. Each plot is surrounded by a metal or concrete frame sunk into the ground. Larger plots are about 15 to 25 meters (49.2 to 82.0 feet) long and are about a meter or more in width (Fig. 1).

Most of the fertilizer experiments have been with cereal crops such as lowland rice,[4] upland rice, wheat, barley, and naked barley.[5] Lowland rice has received by far the most attention. Tea, mulberry, and tobacco are the chief industrial crops used in fertilizer experiments. A few experiments have been

[1] The information presented in this paper was obtained largely from the Central Agricultural Experiment Station, Nishigahara, Tokyo, and from personal observations made by the author while Head of the Soils and Fertilizer Branch, Agriculture Division, Natural Resources Section, General Headquarters, Supreme Commander for the Allied Powers, Tokyo. Grateful acknowledgement is made to T. Tanada, formerly Scientific Consultant to the Soils and Fertilizer Branch, on leave from the Hawaii Agricultural Experiment Station, for help in compiling the data. Presented before the Division of Fertilizer Chemistry, American Chemical Society meetings Atlantic City, New Jersey, September 19, 1949.

[2] Figures in parenthesis refer to "Literature Cited" at end of paper.

[3] The area of Japan is about 147,000 square miles or approximately the size of Montana. On this area live about 80,000,000 people; a density of 540 persons per square mile for the total area, or 5,330 persons per square mile of cultivated area.

[4] The term "lowland" rice refers to rice which is grown under flooded irrigation during part or all of the growing season.

[5] Naked barley threshes free of the glumes as in common wheat

[6] In nearly every case for the experiments reported in this paper, nitrogen was in the form of NH_4SO_4 (20.3 per cent N), phosphorus as superphosphate (18 per cent P_2O_5), and potassium as K_2SO_4 (49 per cent K_2O).

conducted with Satsuma orange, apple, and pear trees. Relatively little work has been done with vegetable crops other than sweet potatoes and white potatoes.

Although much of the experimental technique used in Japan may not measure up to United States standards, in numbers of experimental stations Japan far outclasses the United States. Salmon (*10*) states there are a total of 595 experimental stations of one kind or another. Some of these can be classed as service stations. If these 171 service stations are excluded, 424 remain whose primary function is research. Of these research stations, 225 stations (*11*) deal primarily with field crop research, *i.e.*, rice, wheet, barley, etc., but not fruits, mulberries, silk or vegetables.

Fig. 1. Experimental plots in Japan, Central Agricultural Experiment Station, Konosu, Saitama Prefecture

This paper is a compilation of selected data on field experiments showing results secured from different amounts and kinds of commercial fertilizer applied to the following principal agricultural crops of Japan: lowland rice, upland rice, wheat, barley, naked barley, white potato, sweet potato, Satsuma orange, tea and mulberry. Investigations were concerned only with nitrogenous, phosphatic, and potassic fertilizers. The dates and methods of application, and cultural practices for the crops grown conformed to conventional practices in Japan (*16*). The varieties of crops used in the experiments were established varieties for the areas.

Data were selected from reports of Prefectural and Central Agricultural Experiment Stations. A prefectural map of Japan showing the location of field crops experiment stations is given in Fig. 2. Data were not used from experiments which were altered, revised, or changed in location during the course of the experiment. Only when available experimental results were limited in number for a particular crop were experiments of a short-time nature included.

Field Experiments with Rice

Field experiments to determine the effects of fertilizers on the yield of lowland rice (Fig. 3) have been carried out at many prefectural agricultural experiment stations (*15*). Additional information on rice in Japan has been published by Leonard (*7*). Experimental results obtained from 10 stations distributed throughout Japan show that rice yields from plots receiving no fertilizers averaged 54 per cent of the yields from plots receiving complete fertilization of nitrogen,

Fig. 2. Location of field crop experiment stations (after Tanada and Swanson (15))

phosphorus, and potassium.[6] When phosphorus and potassium were added, but nitrogen was not, yields were 59 per cent of those completely fertilized. Similar comparisons show that yields averaged 94 per cent when only phosphorus was omitted and 92 per cent when only potassium was omitted from applied fertilizers.

The effect on yield of upland rice, when only nitrogen was omitted, was about the same magnitude as for lowland rice. When either phosphorus or potassium was omitted, however, upland rice yields were reduced to a greater degree than lowland rice yields. The absence of phosphorus or potassium in the fertilizers applied to upland rice resulted in average yields of 85 and 80 per cent, re-

spectively, compared with yields from complete fertilization.

Plot experiments conducted continuously for 16 years at the Central Agricultural Experiment Station, Konosu, Saitama Prefecture, show that lowland rice yields from plots receiving no fertilizers were only about 60 per cent of yields from plots that received complete fertilization. Data from these experiments also show that organic and inorganic nitrogenous fertilizers were equally effective in increasing lowland rice yields.

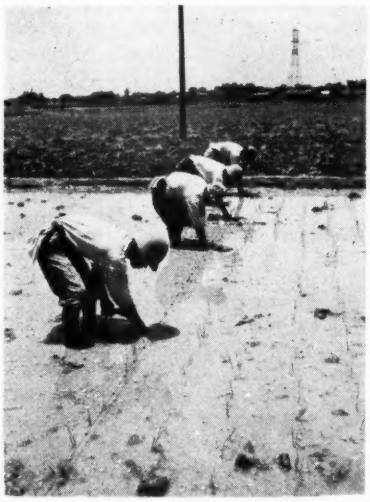

Fig. 3. Transplanting rice seedlings for experimental purposes

In a field experiment in Hokkaido (*8*), night soil (human excrement) was applied to crops of spring wheat and rice. The results indicate that night soil was usually more effective for these crops when applied as a top-dressing than when used at planting time.

The effects of applying varying amounts of nitrogenous fertilizers on yields of lowland rice were studied at eight prefectural agricultural experiment stations (*15*). Data indicate only small additional yield increases when more than about 101.5 kg. of N per hectare (90.5 lb./acre) were applied. Results are shown graphically in Fig. 4 for the experiment at Miyazaki Prefectural Agricultural Experiment Station. In all the studies where nitrogen was added in varying amounts constant amounts of phosphatic and potassic fertilizers were added to each plot. These amounts were probably sufficient for good crop growth and did not limit yields.

At six prefectural agricultural experiment stations, field experiments were conducted similar to those described in the preceding paragraph except that phosphorus was added in varying amounts while nitrogen and potassium applications were constant. The data indicate that additions of increasing amounts of phosphorus had little effect on raising the yield of rice above the yields obtained from the smallest application of 20.3 kg. of P_2O_5 per hectare (18.1 lb./acre).

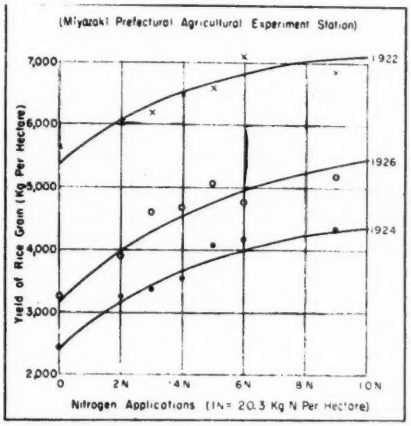

Fig. 4. Influence of nitrogen on lowland rice yield in Japan

Data from five field experiments conducted in five prefectures show that yields of lowland rice were not materially increased by increasing applications of potash above 20.3 kg. per hectare (18.1 lb. acre). At the Mie Station, however, some increase (15 per cent) was obtained from additional potassium applications up to 40.6 kg. of K_2O per hectare (36.2 lb./acre).

Field Experiments with Wheat, Common Barley, and Naked Barley

Greatest decreases in yields of wheat, common barley and naked barley occurred when nitrogen was not applied (*15*). Average yields from no-nitrogen plots in comparison with corresponding yields from plots receiving complete fertilization were: wheat, 30 per cent; common barley, 46 per cent; and naked barley, 38 per cent. When no phosphate was used, average yields in comparison to corresponding yields from plots receiving complete fertilizer were as follows: wheat, 62 per cent; common barley, 60 per cent; and naked barley, 77 per cent. Similarly, when potash was omitted, the average yields

(Continued on page 24)

THE AMERICAN FERTILIZER
ESTABLISHED 1894

PUBLISHED EVERY OTHER SATURDAY BY
WARE BROS. COMPANY
317 NORTH BROAD ST., PHILADELPHIA 7, PA.

A Magazine international in scope and circulation devoted exclusively to the Commercial Fertilizer Industry and its Allied Industries

PIONEER JOURNAL OF THE FERTILIZER INDUSTRY

A. A. WARE Editor

K. F WARE, Advertising Manager

ANNUAL SUBSCRIPTION RATES

U. S. and its possessions, also Cuba and Panama.....$3.00
Canada and Mexico..... 4.00
Other Foreign Countries..... 5.00
Single Copy..... .25
Back Numbers..... .50

Vol. 112 FEBRUARY 4, 1950 No. 3

Principal Articles in This Issue

Radioactive Research Committee Plans 1950 Program

In a recent report on the work of the Industry Committee on Radioactive and Tagged Element Research, Chairman Vincent Sauchelli states that during 1950, in 20 states and in Canada, 39 field experiments will be conducted.

The objectives are a comparison of sources; of degree of ammoniation; the residual value of previous fertilizer application; time and rate of application; fertilizer placement; effect of liming and soil *p*H; effect of soil moisture; effect of nitrogen fertilization; and comparison of crops.

A total of 290 lbs. of P_2O_5 and 26.4 curies of radioactive phosphorus P32 will be prepared and supplied to the experimenters by the U.S.D.A. Bureau of Plant Industry, Soils and Agricultural Engineering at Beltsville, Md.

The states where experiments are to be conducted are Alabama, Arizona, Colorado, Georgia, Idaho, Indiana, Iowa, Maine, Michigan, Minnesota, Mississippi, North Carolina, Ohio, Oregon, South Carolina, Texas, Utah, Virginia, Washington, Wisconsin, and Saskatchewan, Canada. In addition, the Bureau of Plant Industry at Beltsville will sponsor special greenhouse and laboratory studies at the Colorado and Iowa Agricultural Experiment Stations.

Contributions to the 1949–50 research, totaling $22,800, were made by the following companies:

American Cyanamid Co., Armour Fertilizer Works, The Baugh & Sons Co., The Consolidated Mining & Smelting Co. of Canada, Consolidated Rendering Co., Cooperative G.L.F. Exchange, Inc., The Davison Chemical Corp., Eastern States Farmers' Exchange, Georgia Fertilizer Co., International Minerals & Chemicals Corp., Knoxville Fertilizer Co., Mathieson Chemical Corp., Mutual Fertilizer Co., Naco Fertilizer Co., Northern Chemical Industries, Inc., Reading Bone Fertilizer Co., Robertson Chemical Corp., The Smith Agricultural Chemical Co., Smith-Douglass Co., Inc., Southern Fertilizer & Chemical Co., Swift & Co., Tennessee Corp., Texas Gulf Sulphur Co., I. P. Thomas & Son Co., Virginia-Carolina Chemical Corp.

A meeting of the Committee will be held at Beltsville on February 17th to decide what future course should be recommended to the fertilizer industry with respect to this general research program.

Potash Strike Ended

The strike of the miners at the three potash producing plants in Carlsbad, New Mexico, ended on February 1st. On that day, Rufus Poole, spokesman for the three companies announced that a new contract had been signed and that the men would return to work with the minimum of delay.

According to Mr. Poole, the new contract which will remain in effect until May 31, 1950, is virtually the same in economic provisions as the one in force at the time the strike began on November 19, 1949. "There are no wage increases, or changes in pension, insurance or vacation provisions" he said.

The dispute was between the International Union of Mine, Mill and Smelter Workers (CIO) and the United States Potash Company, the Potash Company of America and the International Minerals & Chemical Corporation.

The mines and refineries had been in partial operation for several days before the strike ended, but it is estimated that between seven and eight per cent of the normal supply of potash for the present fertilizer year is lost to this season's production, even with the plants working to 100 per cent capacity between now and the end of the spring season. A certain amount of potash salts, variously estimated up to 40,000 tons K_2O is reported to be on order for import from European sources but how much of this will arrive in time for the present season's mixing is problematical.

Duriron Co. Appoints New Officers

Guy A. Baker has been appointed Vice President in charge of manufacturing, for the Duriron Company, Inc., of Dayton, Ohio.

For several years Mr. Baker has been Assistant to the President and Secretary of the Company. Prior to that he has been Manager of the Duriron Company's alloy castings sales. During his twenty years' association with the Duriron Company, Mr. Baker has been very active in metallurgical research and development. He is affiliated with numerous technical societies.

R. Merton Shields has been appointed Secretary of the Company. He is a mechanical engineer, a graduate of Michigan College of Mining and Technology and prior to his new appointment was manager of the Dayton District Sales for The Duriron Company. He has been with the Company since 1936.

International Minerals & Chemical Promotes Three Executives

Sinclair B. McCoy, for the past five years general traffic manager for International Minerals & Chemical Corporation, has been appointed assistant to A. Norman Into, vice president in charge of the potash division according to an announcement by President Louis Ware. The appointment became effective February 1.

Mr. McCoy, who started with the company in 1927 as a traffic clerk, has devoted his entire career to traffic work in the fertilizer industry and has acquired an extensive knowledge of potash operations. In his new capacity, he will work on special assignments in the potash division, particularly in connection with sales.

Eugene J. Landis, who served as assistant to Mr. McCoy, will succeed him in the position as general traffic manager. Mr. Landis started with the company in 1941 as a rate clerk. At the same time, Ronald A. Ellwing, who has been chief clerk of the traffic department, will be elevated to the position of assistant general traffic manager. Mr. Ellwing joined the company in 1943 as an office boy in the service department.

Nitrogen Improves North Dakota Pastures

Twenty farmers in North Dakota who cooperated with the North Dakota Hay and Pasture Committee in trying out nitrogen fertilizer on hay and pasture found that yields were improved in almost every instance, reports the North Dakota Agricultural Extension Service.

In the trials these farmers applied ammonium nitrate (32 per cent N) in the early spring, broadcast on the fields at a rate of 150 pounds per acre in eastern North Dakota and 100 pounds per acre in western North Dakota. The fertilizer was put on grass hay stands and on fenced grass pastures.

Four-square-yard samples from both fertilized and unfertilized parts of each field were harvested. Dry weight yields were computed by Dr. Warren Whitmen, associate botanist of the Agricultural Experiment Station.

Considerable variation in the yield improvement was noted, due to moisture conditions and other factors. In one instance cattle got through the fenced part of one pasture, making it impossible to compute the yield.

New England Fertilizer Conference To Meet in New Haven

Tentative plans have been completed for the meeting of the New England Fertilizer Conference which will be held at the Connecticut Agricultural Experiment Station at New Haven, Conn., on February 27th and 28th. Sessions will be held on the afternoon of February 27th and on the morning of February 28th. Dr. C. L. W. Swanson, head of the Station's Department of Soils, will preside.

At the meeting on February 27th, Dr. James G. Horsfall, Director of the Connecticut Agricultural Experiment Station, will open the program with remarks on the seventy-five years of agricultural research, as conducted by the Connecticut Station. Other talks scheduled for this session are as follows:

"Functions of the Major and Secondary Plant Food Elements," Dr. T. E. Odland, Rhode Island Experiment Station.

"Minor Elements in Modern Fertilizers," Dr. Vincent Sauchelli, The Davison Chemical Co.

"Alleged Toxic Effects of Inorganic Fertilizers," Dr. F. E. Bear, New Jersey Experiment Station.

Green Pastures Program (sound film) preceded by remarks on the 1950 program, Mr. Lester H. Smith, Extension Agronomist, Vermont.

The Conference Dinner will be held at the Hotel Taft, New Haven, at 6:30 P. M. on February 27th. B. B. Fall, of Rogers & Hubbard Co., Middletown, Conn., will preside and the speaker of the evening will be Dr. Russell Coleman, president of the National Fertilizer Association, who has chosen as his topic "The Fertilizer Industry—100 Years Young."

The program for the meeting on February 28th includes the following talks.

"History of Fertilizer Inspection in Connecticut," Dr. H. J. Fisher, Head, Dept. of Analytical Chemistry, Connecticut Station.

"Soil Structure and Crop Production," Dr. C. L. W. Swanson, Connecticut Station.

"Soil Testing and Its Significance to Northeastern Agriculture," Dr. H. A. Lunt, Dept. of Soils," Connecticut Station.

"Problems in Tobacco Growing," Dr. C. V. Kightlinger, Tobacco Specialist, Massachusetts Agricultural Experiment Station.

"Japanese Agriculture" (Kodachrome slides), J. S. Owens, University of Connecticut.

If conditions permit, the guests will be taken on a tour of the Station at the close of the meeting.

Army Asks Bids on Ohio River Ammonia Plant

The Engineers Corps of the U. S. Army has advertised for bids on the purchase of the Ohio River Ordnance Works, located near Henderson, Kentucky. This plant, which produces synthetic ammonia, was started in March, 1941, and began production in September, 1942.

The process employs coke and air as its raw materials and the plant is capable of producing 200 tons of ammonia per day. At present, its output is about 60,000 tons per year. The plant is operated by the Solvay Process Company under contract with the Army.

Bids will be opened at 11:00 A. M. (Central Standard Time) on March 31, 1950, at the office of the District Engineer, 830 W. Broadway, Louisville, Ky. Offers will be received either on an all-cash basis or on an extended payment plan over a 10-year period. Detailed specifications of the property and sale terms can be obtained from the District Engineer at the above address.

FERTILIZER MATERIALS MARKET

NEW YORK

Potash Situation Critical. Foreign Potash May Arrive Too Late for Present Season. Many manufacturers Cutting Potash Content of Mixtures. Organic Prices Lower. Superphosphate Shipments Improve. No Price Changes Reported.

Exclusive Correspondence to "The American Fertilizer"

NEW YORK, February 1, 1950

Sulphate of Ammonia

No price changes were noted and producers are making shipments against old contracts, although some buyers are not ordering material out on account of the potash situation. It is thought the movement of this material will increase shortly.

Nitrate of Soda

Shipments are reported as slow at the present time but a pick-up is looked for shortly. No price changes were noted.

Nitrogenous Tankage

With leading manufacturers sold out in most cases for the first half of 1950, this material was in a tight position and buyers' efforts to buy additional material met with limited success. Prices held very firm but no advances were reported.

Castor Pomace

The price of this material was increased to $30.50 per ton, f.o.b. production points, due to increased demand from certain sections. This is an advance of $3.00 per ton.

Organics

Demand for tankage and blood from both the fertilizer and feed trade was rather slow and prices tended toward lower levels. Blood sold as low as $7.25 and tankage at $7.75 per unit of ammonia ($9.42 per unit N). The South American market is much higher and importers are unable to bring material in at these prices. Soybean meal was weak, selling down to $52.00 per ton in bulk, f.o.b. Decatur, Ill. Linseed meal sold as low as $65.50 per ton in bulk, f.o.b. Eastern points. Cottonseed meal was slow with little trading reported.

Fish Meal

Due to increased importations, this material was a little lower in price and offerings seemed to be adequate to fill buyers' needs. Most feed buyers were out of the market. Prices as low as $155.00 per ton for the imported material were heard.

Bone Meal

A good movement was reported of fertilizer bone meal, both steamed and raw, but feeding bone meal was in rather limited demand due to the poor feed business at the present time.

Hoof Meal

Several cars of this material were sold at $7.25 (8.82 per unit N), f.o.b. Chicago, with the market well cleaned up.

Superphosphate

A better movement was reported of this material in some directions and in other sections buyers were refusing to take delivery on contract because they had no potash to mix with it. While no further price changes were reported, the price situation was said to be on the easy side.

Potash

The potash situation has reached the critical stage due to the long drawn out strike and many plants are now completely without this material. Some very large orders have been placed for foreign material but so far this is mostly for 60-day shipment. It is feared some of it may arrive too late for use this season. Already many manufacturers are making plans to cut down on the use of potash in their fertilizer mixtures.

Conditioners

Low grade ammoniates were moving conditioners slowly as buyers were hampered by lack of potash in their mixing operations and were unable to take on any additional material of this type.

PHILADELPHIA

Materials Market Not Very Active. Better Movement of Mixed Fertilizers but Potash Shortage Hampers Production

Exclusive Correspondence to "The American Fertilizer"

PHILADELPHIA, January 31, 1950

Activity in raw fertilizer materials is quite limited. The potash strike is still on and while mixed fertilizer is moving more freely to the farmers, it is feared that some of them will go through the spring considerably short of the potash they require.

Sulphate of Ammonia.—This is moving rather slowly, due principally to confusion in the mixing trade caused by the potash strike. There are no price changes noted and the supply is quite sufficient to meet all requirements.

Nitrate of Soda.—Demand continues seasonal with ample stock to satisfy the demand. Movement in some sections has increased, and it is being suggested by some interests that an increased use of nitrate at this time might serve as a substitute for potash. This suggestion might well increase the present demand for nitrate of soda, but whether the farmer will benefit is another question. In any event, the supply is plentiful.

Blood, Tankage, Bone.—Blood and tankage remain fairly steady at slightly reduced prices. Blood is quoted $8.00 to $8.25 per unit of ammonia ($9.72 to $10.02 per unit N), with tankage about 25 cents per unit higher. Bone remains at $65.00 per ton in Chicago with better demand for fertilizer than for feeding. Hoof meal is in rather limited supply at $7.50 per unit of ammonia ($9.12 per unit N) in the Chicago area.

Castor Pomace.—This is in good demand but nothing is offering at this time. Production is contracted ahead.

Fish Scrap.—Market is rather quiet and steady at $170.00 for menhaden meal, with scrap at $160.00 per ton.

Phosphate Rock.—Movement continues to be retarded by inability of mixing plants to take delivery, but this situation will be eased as soon as potash is obtainable.

Superphosphate.—Price range is from 73 cents to 76 cents per unit, depending on the seller. Movement is a little freer but is still held in check by the potash strike.

Potash.—The strike is still unsettled but it is expected there will shortly be resumption of some production, though in rather limited quantity. Prospects are just a little brighter.

CHICAGO

Packing House Organics Show Unexpected Weaker Trend. Buying Interest Low and Prices Decline

Exclusive Correspondence to "The American Fertilizer"

CHICAGO, January 30, 1950

Somewhat to the surprise of most people, the market on animal ammoniates turned decidedly weaker. The general impression has been that with the renewal of export limitations and the bad weather prevailing, the demand for proteins would increase substantially and result in higher prices. However, the market went in the other direction and at present there is a total lack of confidence, with buying interest at a minimum. The price decline in the past two weeks amounts to approximately $15.00 per ton.

Ground and sacked meat scraps, 50 per cent protein, are now rated at $90.00 to $95.00 per ton. Digester tankage is nominal at $100.00 to $105.00 per ton although it is conceded that even lower bids might be accepted. Dry rendered tankage ranges from $1.50 to $1.60 per unit of protein delivered. On wet rendered tankage, high testing material is quoted at $7.50 to $7.75 ($9.12 to $9.32 per unit N) and low test material, $8.25 to $8.50 per unit of ammonia ($10.02 to $10.33 per unit N) delivered. Dried blood is offered at $7.00 per unit of ammonia ($8.51 per unit N), but there is no buying interest. Steamed bone meal, 65 per cent B.P.L., in bags, is quoted nominally at $70.00 per ton; raw bone meal, 4½—45 per cent, at $75.00 per ton.

CHARLESTON

Fertilizer Organics in Tight Supply. Shipments of Superphosphate Increasing. Potash Production in Limited Volume Reported

Exclusive Correspondence to "The American Fertilizer"

CHARLESTON, January 30, 1950

Organics are in tight supply and prices strong. Superphosphate stocks continue heavy and movement tending to increase. Potash strikes at the Carlsbad mines continue to hamper production of mixed fertilizers and the situation now has reached serious proportions.

Organics.—Fertilizer grade organics continue in extremely tight position, with the prime producers of nitrogenous tankage completely sold up for several months. Prices are nominally $3.75 to $4.00 per unit of ammonia ($4.56 to $4.86 per unit N) in bulk f.o.b. production points. Dried ground blood and packing house tankages remain too high in price to interest most fertilizer manufacturers. Imported organics, when quoted, are for arrival too late to help most fertilizer manufacturers in the United States.

Castor Pomace.—Producers are in a sold up position and movement is entirely against existing contracts. Price is nominally $30.50 per ton in bags, f.o.b. Northeastern production points. This is an increase of $3.00 per ton over sale price for January.

Dried Ground Blood.—The New York market is around $8.00 per unit of ammonia ($9.72 per unit N) in bulk with the Chicago market around $7.00 ($8.51 per unit N). Interest is slack and the market quiet.

Potash.—It is reported that some workers in the strikebound Carlsbad area have reported back at work but volume of production is quite limited. No positive news has broken regarding settlement of the strikes. Production lost to date is estimated better than half a million tons of potash material.

Ground Cotton Bur Ash.—Heavy sales of this source of carbonate of potash continue at around 65 cents per unit of K_2O in bulk, f.o.b. production point in Texas. Bur ash tests approximately 30 per cent to 40 per cent K_2O, and 3 per cent to 4 per cent chlorine. Buyers are reported using this material for lack of sulphate and also muriate of potash.

Price in bags delivered Northeastern destinations is around $1.75 per unit of K_2O.

Phosphate Rock.—Shipment from Florida mines is described as fair. Movement is expected to improve soon as demand for mixed fertilizers increases. Prices are firm.

Superphosphate.—Prices around Carteret, N. J. and Baltimore are reported firm at 73 cents and 76 cents per unit of A.P.A., in bulk, respectively. Movement of heavy stocks to the South and Southeast has improved.

Sulphate of Ammonia.—Supplies continue plentiful and demand is expanding in proportion to the demand from farmers for mixed fertilizers. This demand has been improved, as farmers are told that supplies of potash are uncertain and that they should call for their fertilizers as soon as possible.

Ammonium Nitrate.—Demand continues steady and supply sufficient. No recent price changes have been noted.

Nitrate of Soda.—Demand continues seasonal and prices unchanged.

American Plant Food Council and National Grange Announce New Essay Contest

A nation-wide essay contest on "Soil Fertility and the Nation's Future" with $10,000 in prizes has been announced by the National Grange and the American Plant Food Council for young men and women through 20 years of age, beginning February 1, and ending April 15, 1950.

Under-Secretary of Agriculture, A. J. Loveland, is Chairman of the National Board of Judges for the contest, and other members of the Committee are: Dr. Hugh H. Bennett, chief, Soil Conservation Service, U.S.D.A.; Miss Lois Clark, Assistant Director, Division of Rural Service, National Education Association; Dr. W. T. Spanton, chief Agricultural Education Service, U. S. Office of Education; and Dr. M. L. Wilson, director of Extension Work, U.S.D.A.

Albert S. Goss, Master of the National Grange, and Clifton A. Woodrum, President of American Plant Food Council, in a joint statement said that the sponsors of the contest "are vitally concerned not only with the problems of maintaining and increasing the fertility of our soils, but with the wise use of our land so as to maintain a healthy, prosperous agriculture."

"We hope," they said, "that this contest will stimulate both interest and solutions to the important task of safeguarding our soil's fertility which is directly related to the future of our Nation.

"As our agricultural patterns change, the youth of our Nation will play an increasingly important role in the leadership which seeks to maintain farming as a productive and profitable enterprise."

Prizes offered by the American Plant Food Council are: National—first prize, $1,000; second prize, $500; third prize, $400; fourth prize, $300; fifth prize, $300; and sixth, $300.

In states where the Grange is organized, entries are to be sent to the nearest Subordinate Grange. In non-Grange states, participants are eligible only for national awards and should send their entries to the Contest Committee, National Grange, 744 Jackson Place, N. W., Washington 6, D. C.

The contest judges explained that each entrant's essay "may be based upon data from text books, bulletins, interviews or personal experience" but expressed the hope that all entrants "would give special consideration to the practical application of the subject to the soils of their communities."

Entries must not exceed 800 words and will be judged on the basis of 55 points for effectiveness, 20 points for originality, 15 for practical application of subject matter, and 10 for grammatical correctness.

American Plant Food Council Announces Dates for 1950 Convention

Clifton A. Woodrum, president of the American Plant Food Council, has announced that the Fifth Annual Convention of the organization will be held at The Homestead in Hot Springs, Virginia, June 29–30 and July 1–2.

One of the outstanding features of the 1950 convention program will be the awarding of prizes in the Council's 1950 essay contest on "Soil Fertility and the Nation's Future" jointly sponsored with the National Grange.

In addition, nationally-known educators, agricultural leaders, soil scientists and others will be among the speakers.

The Convention Committee is composed of: J. A. Howell, President, Virginia-Carolina Chemical Corporation, Richmond, Va., Chairman; A. F. Reed, Vice President, Lion Oil Company, El Dorado, Ark.; R. C. Simms, President, Naco Fertilizer Company, New York, N. Y.; Paul Speer, Vice President, United States Potash Company, New York, N. Y.; W. T. Wright, Vice President, F. S. Royster Guano Company, Norfolk, Va.; and Fred J. Woods, President and Treasurer, The Gulf Fertilizer Company, Tampa, Fla.

Second-Year Alfalfa Needs Good Supply of Potash

Good vigorous second-year stands of alfalfa demand an adequate supply of potash, according to R. H. Simon of the agronomy department at the Ohio Agricultural Experiment Station.

The first year's cuttings have utilized the potash from any previous manure top dressings and the small amount from the fertilizer on the previous grains crop. Potash from the soil minerals becomes available slowly, hence yields of the second-year stands of alfalfa are often limited by an adequate supply of potash.

Four hundred pounds of 0–10–20 or 0–12–12 fertilizer is recommended for the second harvest year and every other year thereafter on long-lay alfalfa stands. The potash added in this fertilizer schedule, together with that regularly released from soil minerals, should supply the plants with this element in amounts necessary for maximum growth, Simon points out.

As alfalfa requires four or five times as much potash as phosphoric acid, manure beyond the usual application would be required to satisfy this demand or the available supply of potash from the soil minerals will be depleted. On good, well-limed alfalfa soil, an annual fertilizer program is necessary to supply the continual demand of alfalfa for potash when high yields of good quality hay are desired.

Fertilizer Recommendations for Arkansas

A new publication recently issued by the Arkansas Agricultural Extension Service will bring Arkansas farmers up-to-date on the latest fertilization practices in production of field crops, fruits and vegetables.

Compiled by Extension specialists, "Fertilizer Recommendations for Arkansas" is based on tests conducted over a long period of years by the University of Arkansas College of Agriculture.

Authors of the circular put special emphasis on adding to the soil the right kinds and amounts of plant foods for each specific crop the farmer intends to grow. This usually calls for a soil analysis, available free of charge through county agents of the Extension Service. Agents will assist in taking soil samples, and will forward them to the Uni-

versity's Soil Testing Laboratory at Fayetttville.

Though stressing the importance of fertilization, the publication points out two other big factors to consider in setting up a long-range soil improvement program. It recommends (1) a sound crop rotation and (2) growing of winter cover crops, particularly legumes, to protect and enrich land.

Strike Prevents Record Potash Production during 1949

Deliveries of potash in North America during 1949 by the five leading producers and two importers amounted to 2,104,820 tons of potash salts containing an equivalent of 1,145,793 tons K_2O. This was a decrease of 28,049 tons K_2O or 2.4 per cent under 1948, due to a strike of potash miners in the Carlsbad area beginning November 19, 1949, and continuing past the end of the year. Prior to that date, deliveries in 1949 had been running well ahead of last year. Included in the above figures are 65,912 tons of salts of French origin with an equivalent of 40,126 tons K_2O. There were no importations of German potash during the calendar year.

Deliveries for agricultural purposes in the continental United States for 1949 were 972,154 tons K_2O, a decrease of 5,227 tons under 1948. Canada received 65,028 tons K_2O, Cuba 5,151 tons, Puerto Rico 14,320 tons, and Hawaii 11,535 tons. Exports to other countries amounted to 11,040 tons K_2O.

In this country the potash was delivered in 45 states and the District of Columbia. Ohio with over 90,000 tons K_2O was the leading state in deliveries of agricultural potash and was followed in order by Georgia, Illinois, North Carolina, Virginia, and Florida, each taking more than 60,000 tons K_2O during the year. Due to shipments across state lines, consumption does not necessarily correspond to deliveries within a state.

The 60 per cent muriate of potash continues to be by far the most popular material, comprising 81 per cent of the total K_2O delivered for agricultural purposes. The 50 per cent muriate of potash made up 8 per cent, manure salts 4 per cent, and sulphate of potash and sulphate of potash-magnesia 7 per cent of deliveries. With increased refining capacity brought into production during the year, a greater proportion of the deliveries was in the form of the more concentrated forms, with a falling off in manure salts.

Deliveries for chemical purposes in 1949 were 101,283 tons of muriate of potash containing an equivalent of 63,409 tons K_2O, and 6,230 tons of sulphate of potash containing 3,156 tons K_2O. The total chemical deliveries of 66,565 tons K_2O were 21,461 tons or 24 per cent less than in 1948.

POTASH DELIVERIES
SHORT TONS K_2O

	Calendar 1949	Calendar 1948
Agricultural		
UNITED STATES		
Muriate 60%	778,896	761,696
Muriate 50%	87,089	72,009
Manure Salts	45,205	67,136
Sulphate and Sul. Pot-Mag.	60,964	76,540
Total	972,154	977,381
(Imports)*	(17,211)	(18,240)
CANADA	65,028	62,198
(European Imports)	(22,915)	(21,829)
CUBA	5,151	3,982
PUERTO RICO	14,320	19,471
HAWAII	11,535	9,153
Total Institute Territories	1,068,188	1,072,185
Other Exports	11,040	13,631
Total Agricultural	1,079,228	1,085,816
(Imports)*	(40,126)	(40,069)
Chemical		
UNITED STATES		
Muriate 60%	63,140	82,873
Sulphate of potash	3,111	4,673
Total	66,251	87,546
CANADA		
Muriate 60%	269	480
Sulphate of potash	45	—
Total Chemical	66,565	88,026
Grand Total	1,145,793	1,173,842
(Imports)*	(40,126)	(40,069)

*Import figures in parentneses are included in all totals.

In the fourth quarter of 1949, deliveries totaled 441,448 tons of salts containing an equivalent of 232,876 tons K_2O, a decrease of 30 per cent compared to K_2O delivered during the same period in 1948. This was due to the strike of potash miners in the Carlsbad area. The continental United States received for agricultural purposes 189,962 tons K_2O, Canada 32,452 tons, Cuba 820 tons. Puerto Rico 646 tons, and Hawaii 6,492 tons. Exports to other countries were 2,504 tons K_2O. The Canadian figure for the quarter is abnormally high since it includes deliveries of French potash during the entire year.

Chemical deliveries during the fourth quarter amounted to 28,899 tons of salts with an equivalent of 17,935 tons K_2O, a decrease of 19 per cent under the same period in 1948. Of the 1949 total, muriate of potash equivalent to 17,108 tons K_2O and sulphate of potash containing 827 tons K_2O were delivered in the United States and 50 tons K_2O as muriate in Canada.

Stewart Elected Executive Vice-President of Federal Chemical

On January 10th, Jefferson D. Stewart, Jr., was elected Executive Vice-President of the Federal Chemical Company, Louisville, Ky.

Mr. Stewart joined the Federal organization at their Tennessee plant in 1936, following his graduation from Williams College. During World War II, he served as a Lieutenant in the Navy. On returning to the company, he was assigned to the department of production management. He was placed in charge of the purchasing department in 1947 and was elected a vice-president in August of that year.

Bagpak Opening Denver Office

International Paper Company's Bagpak Division is opening a branch sales office in Denver, Colorado. Russell A. Gair is the district sales manager.

The Denver office is Bagpak's sixteenth district sales office. The other fifteen are located in Atlanta; Baltimore; Baxter Springs, Kans.; Boston; Camden, Ark.; Chicago; Cleveland; Los Angeles; Nazareth, Pa.; New Orleans; Philadelphia; Pittsburgh; St. Louis; San Francisco; and Wooster, Ohio.

Bagpak Division makes heavy-duty multiwall kraft paper shipping sacks used by the cement, fertilizer, lime and limestone, food products, chemical, and other industries.

JAPANESE FERTILIZER EXPERIMENTS

(Continued from page 9)

were: wheat, 53 per cent; common barley, 82 per cent; and naked barley, 84 per cent.

Twenty-year continuous field experiments with wheat at the Central Agricultural Experiment Station, Konosu, Saitama Prefecture, show that on a plot (Plot A) receiving no fertilizer, wheat yields averaged only 32 per cent of yields from a plot (Plot B) which received a complete fertilizer application. Plots B, C and D received the same equivalent amounts of nitrogen, but in different forms. Plot B, which received nitrogen in the form of ammonium sulphate, had the highest average yield for the 20-year period. Plot D, which received one half the nitrogen in an inorganic form (ammonium sulphate), and the remaining one half in an organic form (soybean cake and stable manure), produced yields almost as large as Plot B. Yields from Plot C, on which all applied nitrogen was in an organic form (soybean cake and stable manure), were 84 per cent of yields from Plot B.

At several prefectural agricultural experiment stations, increasing amounts of nitrogen were added to the wheat crop, but the amounts of phosphate and potash applied were kept constant during the field experiment. Experiments were also run on wheat, where either the phosphate or potash applications were increased while the other fertilizers were kept at constant levels. The data indicate that on the average no significant increases in yield increments were obtained when quantities in addition to 81.2 kg. of N per hectare (72.4 lb./acre) were applied; that no appreciable increases in yield resulted when quantities in addition to 60.9 kg. of P_2O_5 (54.3 lb./acre) were added; and that 60.9 kg. of K_2O (54.3 lb./acre) gave about the maximum yield. Fig. 5 shows the influ-

ence of a two-year application of nitrogen on wheat yields at the Shimane Prefectural Agricultural Experiment Station. At this location the response to N was greater than the average.

Field experiments with naked barley, conducted in four prefectures on a basis similar to the experiments described in the preceding paragraph, show that with increasing amounts of nitrogen the yields of naked barley increased at a fairly constant rate. At a rate of as high as 162.4 kg. of N per hectare (144.9 lb./acre) the yield was 459 per cent greater than the check plot. Yields did not materially increase when amounts greater than 41 kb. of P_2O_5 (36.6 lb./acre) per hectare were applied. Yields of naked barley continued to increase only in small amounts when additions of potash above 41.6 kg. of K_2O per hectare (36.6 lb./acre) were applied. Fig. 6 shows that the effect of phosphate applications, as reflected in yield of naked barley, varies from year to year.

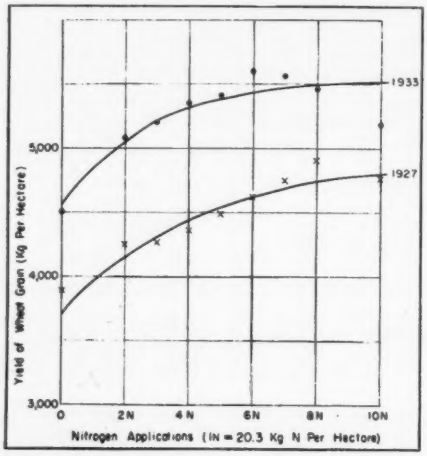

Fig. 5. Effect of nitrogen on wheat yields at the Shimane Prefectural Agricultural Experiment Station in Japan

At the Saitama Prefectural Agricultural Experiment Station, increased yields of common barley were obtained where amounts up to 102 kg. of N per hectare (90.9 lb./acre) were applied when phosphate and potash applications were kept at constant levels. Yields of common barley were substantially increased when P_2O_5 in amounts up to 81 kg. per hectare (72.2 lb./acre) were added to the soil. Additional increases in yield were obtained from applications of potassic fertilizers with rates as high as 81 kg. of K_2O per hectare (72.2 lb. acre).

Field Experiment With Sweet Potato and White Potato

In field experiments conducted at the Chiba Prefectural Agricultural Experiment Station (*15*), potash was found to be the fertilizer constituent most effective in increasing yields of sweet potatoes. Sweet potato yields were practically nil after one year without addition of potassic fertilizer to the experimental plot receiving nitrogen and phosphorus. Yield increases from applications of nitrogenous and phosphatic fertilizers were materially less in these experiments. Omission of nitrogen from applied fertilizers resulted in an average reduction of 11 per cent in yield, and the omission of phosphoric acid resulted in an average reduction of 17 per cent. Additional information on fertilizing rates for sweet potato are given by Boswell (*2*).

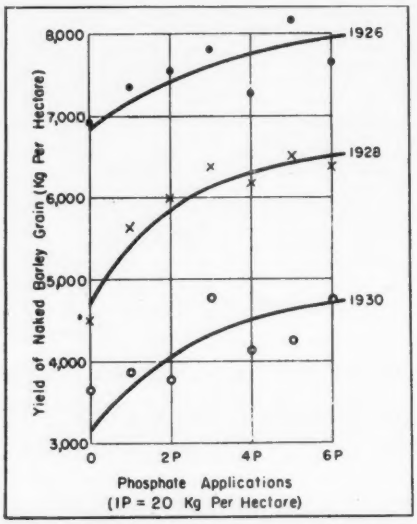

Fig. 6. Effect of phosphate fertilization on naked barley yield at the Miyazaki Prefectural Agricultural Experiment Station, Japan

At the Fukushima Prefectural Agricultural Experiment Station additional applications of nitrogen did not significantly increase the yield of sweet potatoes. With phosphates, additional applications up to 40.6 kg. of P_2O_5 per hectare (36.2 lb./acre) resulted in 13 per cent greater yields. When potash applications were increased, amounts up to 81.2 kg. of K_2O per hectare (72.4 lb./acre) gave an increase of as much as 22 per cent larger yields in comparison with a no-potash plot.

The results obtained with experiments using white potatoes show that no appreciable

increase in yields of white potatoes was produced from the use of quantities in addition to 61 kg. of N per hectare (54.4 lb./acre). For P_2O_5, however, yields continued to increase when as much as about 183 kg. of P_2O_5 (163.2 lb./acre) were added to the soil. With K_2O_5 no large increase in yields was obtained when amounts in excess of 122 kg. of K_2O per hectare (108.8 lb./acre) were applied

Field Experiments with Satsuma Oranges

Data obtained from a field experiment with Satsuma (mandarin) oranges at the Hiroshima Prefectural Agricultural Experiment Station (*15*) show that applications of nitrogen, phosphate, and potash above certain amounts[7] did not increase materially the yield of this crop. When the fertilizer nutrients were applied at rates which were three times the normal rates, production of Satsuma oranges actually decreased.

Field Experiments with Tea

Experimental data on the effect of nitrogen applications on tea yields in Shizuoka Prefecture (*15*) show that, depending on the kind of nitrogenous fertilizer used, yields of tea leaves increased from 42 go 74 per cent over yields of the check plot which received no nitrogen. Organic forms of nitrogen (soybean cake and rape seed cake meal; 68 and 74 per cent increase, respectively) produced greater yields of tea than did the inorganic form (ammonium sulphate, 42 to 49 per cent increase) used in this experiment.

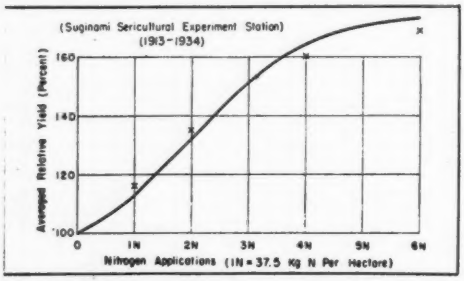

Fig. 7. Effect on yield of mulberry leaves of increasing nitrogen applications in Japan

Field Experiments with Mulberry

Experiments using various kinds of nitrogenous fertilizers for fertilizing mulberry trees have been conducted (*15*). The results indicate that inorganic forms of nitrogenous fertilizers are more effective than organic forms in increasing the yields of mulberry leaves. Calcium nitrate maintained the yield of mulberry leaves better than any of the other fertilizers used in the experiment although ammonium nitrate was almost as effective as calcium nitrate. The maximum yield of mulberry leaves was harvested four to five years after the trees were planted and that after about 17 to 18 years the yields decreased about 20 to 30 per cent.

One experiment showed that yields of mulberry leaves and branches continued to increase with larger applications of nitrogen, phosphate, and potash, up to certain limits. The optimum fertilizer rate for greatest yields varied somewhat with location. Nitrogen appeared to be of greatest need for maximum leaf production, and phosphate and potash were of lesser importance. The effect of nitrogen on the production of mulberry leaves is shown in Fig. 7.

(*To be continued in next issue*)

[7] About 280 grams each of N, P_2O_5, and K_2O per tree.

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(2) Boswell, V. R. "Sweet Potatoes in Japan." *Nat. Hort. Mag.* 27:14–27. 1948.

(3) Christensen, R. P. "Efficient Use of Food Resources in the United States." *U. S. Dept. Agric. Tech. Bul.* 963. 1948.

(4) Clark, K. G. and Sherman, M. S. "Prewar World Production and Consumption of Plant Foods in Fertilizers." *U. S. Dept. Agric. Misc. Publ.* 593. 1946.

(5) *Crops and Markets.* 1949 Edition, Vol. 26. Bur. Agr. Econ. U. S. Dept. Agric., Washington, D. C.

(6) Leonard, W. H. "Barley Culture in Japan." *Jour. Amer. Soc. Agron.* 39:643–658. 1947.

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(9) Reports of the Commissioner of Agriculture for 1878, 1879, 1880, 1881, and 1882. Washington, D. C.

(10) Salmon, S. C. "The Agricultural Experiment Stations of Japan." Nat. Res. Sect., Gen. Hq., Supreme Commander for the Allied Powers, Tokyo. Report No. 59, 1–92. 1946.[12]

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(12) Swanson, C. L. W. "Reconnaissance Soil Survey of Japan." *Soil Sci. Soc. Amer. Proc.* 11:493–507. 1946.

(13) Swanson, C. L. W. "Land Use and Soil Conservation in Japan." *Jour. Soil and Water Conserv.* 3:159–164. 1948.

(14) Swanson, C. L. W. "Preparation and use of Composts, Night Soil, Green Manures, and Unusual Fertilizing Materials in Japan. *Agron. Jour.* 41:275–282. 1949.

(15) Tanada, T. and Swanson, C. L. W. "Field Experiments with Fertilizers in Japan." Nat. Res. Sect., Gen. Hq., Supreme Commander for the Allied Powers, Tokyo. Report No. 86, 1–58. 1947.[12]

(16) Tanada, T. and Swanson, C. W. L. "Fertilizer Practices in Japan". (A preliminary report). Nat. Rés. Sect., Gen. Hq., Supreme Commander for the Allied Powers, Tokyo, Report No. 93, 1–63, 1947.[12]

BUYERS' GUIDE • A CLASSIFIED INDEX TO ALL THE ADVERTISERS IN "THE AMERICAN FERTILIZER"

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Barrett Div., Allied Chemical & Dye Corp., New York City
Commercial Solvents Corp., New York City
Lion Oil Co. El Dorado, Ark.
Phillips Chemical Co., Bartlesville, Okla
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McIver & Son, Alex. M., Charleston, S. C

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International Paper Co., Bagpak Div., New York City
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BAG PRINTING MACHINES
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BAGGING MACHINES—For Filling Sacks
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Baker & Bro., H. J., New York City
Davidson Commission Co., The, Chicago, Ill.
Huber & Company, New York City
Jackle, Frank R., New York City
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Scar-Lipman & Co., New York City
Tuteur & Co., New York City
Woodward & Dickerson, Inc., Philadelphia, Pa.

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International Minerals & Chemical Corporation, Chicago, Ill.
Lion Oil Company, El Dorado, Ark.
McIver & Son, Alex. M., Charleston, S. C.
Phillips Chemical Co., Bartlesville, Okla.
Scar-Lipman & Co., New York City
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Woodward Iron Company, Woodward, Ala.

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Scar-Lipman & Co., New York City
Woodward & Dickerson, Inc., Philadelphia, Pa

A Classified Index to Advertisers in "The American Fertilizer"

BUYERS' GUIDE

For an Alphabetical List of all the Advertisers, see page 33

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- Atlanta Utility Works, The, East Point, Ga.
- Sackett & Sons Co., The A. J., Baltimore ,Md.
- Stedman Foundry and Mach. Works, Aurora, Ind.
- Sturtevant Mill Company, Boston, Mass.

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- Baker & Bro., H. J., New York City
- Scar-Lipman & Co., New York City
- Southern States Phosphate & Fertilizer Co., Savannah, Ga.
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- Atlanta Utility Works, The, East Point, Ga.
- Bradley Pulverizer Co., Allentown, Pa.
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- Stedman Foundry and Mach. Works, Aurora, Ind.
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- Sackett & Sons Co., The A. J., Baltimore, Md.
- Stedman Foundry and Mach. Works, Aurora, Ind.
- Sturtevant Mill Company, Boston, Mass.
- Universal Vibrating Screen Co., Racine, Wis.

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- Sturtevant Mill Company, Boston, Mass.

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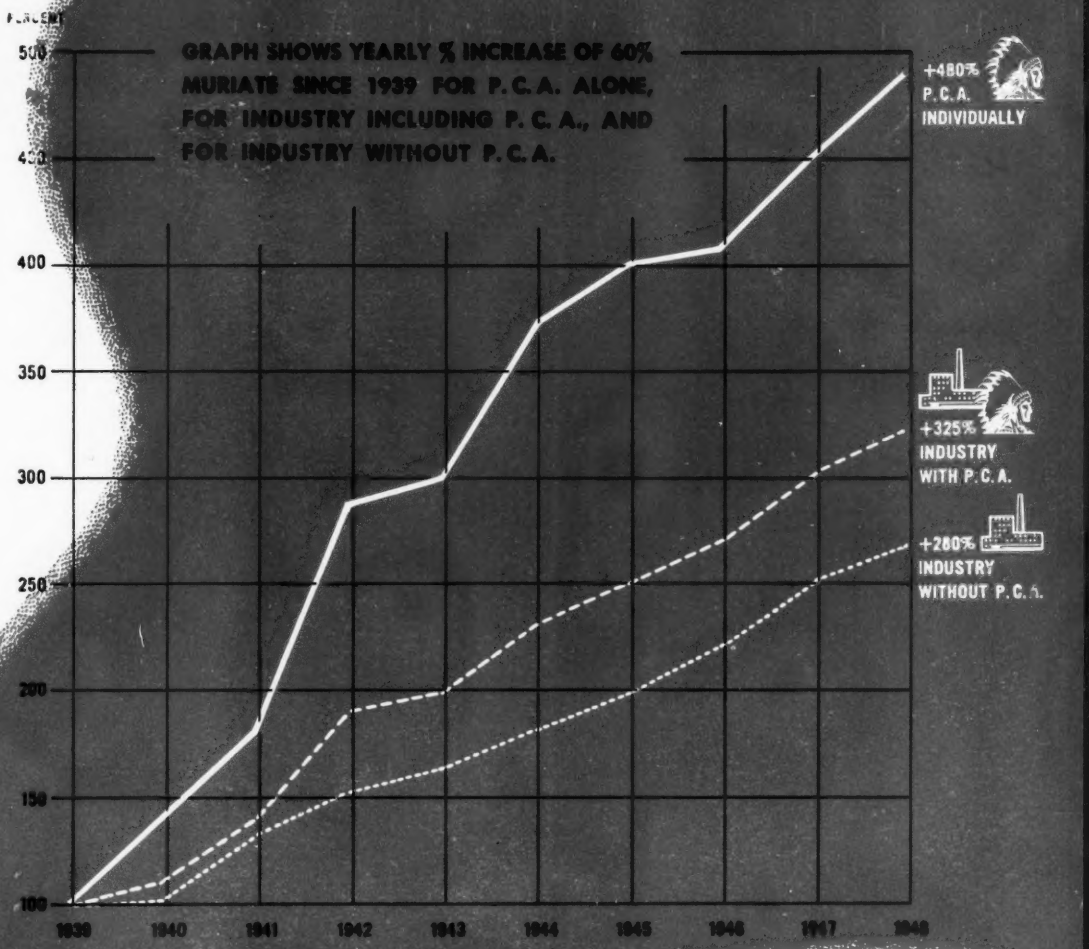

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